

The Microscope, a Close -up Look for the Amateur

Master Teacher: Jeff Duffy

Grade Level: 5-8

Time Allotment: 1-2 fifty-minute class sessions

Overview: Students will make a microscope from a drop of water, to learn the basic parts and functions of a compound microscope. They will observe fresh cells by preparing a wet mount slide and learn the proper technique for setting up and using a compound light microscope. Additionally they will calculate magnification and field of view. Finally, they will learn where to find information about objects that are not readily available in the classroom to observe.

Subject Matter: Science, Math

Learning Objectives:

The student will be able to:

- Demonstrate a working knowledge of the vocabulary associated with the preparation of wet mount slides and proper setup and use of a compound light microscope,
- Set up a compound light microscope and make the necessary adjustments to accurately describe the viewed item, and
- Calculate the field of view, total magnification, and estimate the size of a viewed item.

Standards:

From the National Science Education Standards, Grades 5-8:

- Develop abilities necessary to do scientific inquiry,
- Use appropriate tools and techniques to gather, analyze and interpret data,
- Use mathematics in all aspects of scientific inquiry,

- Develop an understanding of the structure and function in living systems, and
- Appreciate that all organisms are composed of cells.

Media Components:

Video

Simply Science: Lab Skills Training and Review #125

Web Sites:

University of Tennessee

http://www.utmem.edu/personal/thjones/hist/hist_mic.htm

History of the light microscope.

Lucent Technologies

<http://www.lucent.com/minds/innovating/microscapes.html>

Microscapes: The world of the microscope. Microscapes brings you the world too small for the human eye in a series of photographs taken through high power microscopes. At this level of magnification the everyday objects of our lives take on an unrecognizable and sometimes artistic appearance.

Materials:

Compound microscopes: one per student ideal, one per three students acceptable

- Microscope slides: at least one per student
- Cover slips: at least one per slide
- Razor blade, scalpel or knife: one, for the teacher only
- Paper towels or bibulous paper
- Iodine and dropper
- Small metric rulers: one per student ideal, one per three students acceptable
- Beaker of clear water and a dropper for each student

Prep for Teachers:

- Visit the Internet or the library to examine the history of the compound light microscope.
- Be certain that all microscopes are in good working order and those lenses are clean.
- Cue the tape to the section titled "Microscope Skills".
- Have small patches of fabric, small print objects or other items with very fine detail available for viewing with the "water drop" microscope. (Described in "Introductory Activity").

Introductory Activity:

Step 1: Provide each student with a small piece of fabric, hair, or fine print and have them observe with their unassisted eyes and then describe it.

Step 2: Have them cover the object with a clean glass slide, then observe and describe it again.

Step 3: Finally, place a small drop of water on the slide. Have the students look through the drop and describe what has happened to the image. (The curvature of the water drop magnifies the image, forming a simple microscope.)

Step 4: Encourage the students to try layering two slides to form a compound microscope. Use the notion of magnifying a magnified image to begin viewing the video *Simply Science: Lab Skills Training and Review*.

Learning activities:

Step 1: Tell the students that for hundreds of years, scientists have been using microscopes to observe all types of objects. One of its most powerful applications is in the area of life science, where it is arguably the most important piece of technology.

Step 2: **Start** tape where title "Microscope Skills" appears.

Pause: Title "Compound Light Microscope" appears. **Focus for Media Interaction** Ask students what this means. (A microscope of more than one lens and powered by some form of visible light) Answers will vary.

Step 3: **Play:** The supplies needed to prepare a wet mount slide are listed, followed by the procedure.

Pause: Focus The cover slip is tapped gently and the narrator says, "OK". Have the students duplicate this activity. Before further viewing, ask, "What do you think she will see"? Listen to responses, then say. "Let's find out."

Step 4: Play: Little is seen so iodine is applied to the specimen. Ask why the tissue was applied to the point away from where the iodine was introduced. (To draw the iodine across the specimen) Say, "Let's find out what she saw after staining with iodine."

Step 5: Play: The procedures for placing a wet mount slide on the stage, and then focusing the microscope are given.

Pause: She says, "There you can see your wet mount" and a microscope image appears.

Step 6: Rewind and Pause: The slide is placed under the stage clips **Focus:** Say, "Let's watch this again before we try it ourselves."

Play: The students will view the same segment again to emphasize the basic steps for focusing. (Start on low power with the objective lens as close as possible to the object). Note: Some microscopes may differ than those in the video in that the stage may be fixed and the body tube moves.

Pause: She says, "Now you can see your wet mount" and the slide view switches to a close up of a nosepiece. Students should place previously prepared, unstained potato smear on the stage and observe on low power. After all have succeeded in viewing on low power, ask if a more detailed view may be made. (yes, on high power)

Focus Say, "Let's see how this is done."

Step 7: Play: This segment explains how a high power observation is made.

Pause: She says, "There we have it" and a magnified image slides to the side of the screen. Have the students follow the video demonstration and view their wet mount slide on high power. Note: The distance between the slide and the high power objective in the video is atypically great. Use only the fine adjustment knob when on high power. After high power observations have been made, have students compare those observations with low ones. Some should note that there is greater detail on high power but a smaller area is seen. **Focus:** Ask "How do you determine how much area you are viewing. Let's take a look."

Step 8: Play: A technique for measuring the field of view and calculating the powers of magnification is shown.

Stop: She says, "gives us a window into the world that can't be seen with the naked eye" and she looks over her shoulder at the microscope.

Step 9: Have the students use rulers to determine the field of view of their microscopes or brainstorm on other way that that task might be accomplished.

Step 10: Calculate the power of magnification for the different lens combinations.

Culminating activity:

Have the students prepare wet mount slides of various items from the classroom. Cheek cells or scrapings from teeth are great. Diatomaceous earth, root hairs, leaf epidermis, very small insects, or a drop or two of pond water are also great to observe.

Cross-Curricular Extensions:

COMPUTER SCIENCE

Students may research different types of microscopes using the Internet. They may also find sites that allow them to practice "techniques" using virtual microscopes.

MATH

Students can calculate/estimate the real size of organisms viewed with the microscope.

ART

Produce detailed drawings of objects viewed using the microscope.

SOCIAL STUDIES

An explanation of the importance of the microscope and disease can be detailed.

Community Connections:

Students may visit a hospital, medical lab, or veterinary clinic to view the microscope "at work." Visit an observatory or optometrist to see other applications for lenses.

Student Materials:

none